

Chapter Four

Vertical Interplay: The Consequences of Cross-Scale Interactions

THE BOUNDARIES SEPARATING distinct institutional systems - like the boundaries between individual ecosystems - are often fuzzy and difficult to identify with precision. This is a consequence not only of the effects of functional interdependencies linking institutional arrangements to one another but also of the role that social construction plays in determining the scope or domain of individual institutions. As a result, efforts to understand how specific institutions operate at the margins frequently run into trouble. But nothing in these observations alters the facts that human societies located at all levels of social organization are more or less densely populated with well-defined and widely-recognized institutions organized around a variety of functional concerns and spatial domains and that these arrangements frequently interact with one another producing consequences that are too important to disregard.

Given the complexity of individual institutions, it is easy enough to understand why analysts tend to focus on specific arrangements, asking questions about the formation, performance, and evolution of these systems on the assumption that a consideration of forces exogenous to individual institutions is not essential for these purposes. As the number of institutions operating in a given social space or, in other words, institutional density rises, however, opportunities for interplay between or among distinct institutions increase. In complex societies, institutional interplay is a common occurrence, and the resultant interactions can be expected to loom large as determinants both of the performance of individual institutions and of their robustness or durability in the face of various stresses or pressures for change. With regard to institutions that address environmental matters or what are commonly referred to as resource or environmental regimes (Young 1982), this means that interplay is a force to be reckoned with

in evaluating whether regimes produce results that are sustainable, much less outcomes that meet various standards of efficiency and equity.

To prepare the ground for the analysis to follow, several additional distinctions are worth spelling out at the outset. Whether the links are vertical or horizontal in nature, individual cases of institutional interplay range along a continuum from essentially symmetrical interactions to largely unidirectional interactions. Symmetry in this context increases to the extent that the impacts of institutions on one another are reciprocal. Reciprocity is a common feature of interactions between economic and legal/political arrangements where economic activities generate the resources needed to operate political systems but regulatory arrangements impose significant restrictions on the conduct of those engaged in economic transactions. Asymmetrical linkages, by contrast, arise in situations where the operation of one institution affects others significantly, without triggering the occurrence of equivalent responses. Asymmetry is common where global or regional arrangements produce initiatives, such as the European Union's ban on the importation of certain seal products, that have dramatic consequences for local institutions (e.g. the mixed economies of remote communities located in Greenland and the eastern Canadian Arctic) that are unable to respond in any effective way (Wenzel 1991). Of course, symmetry in this connection is a variable. It can range from high to low across the universe of cases in which institutional interplay is a significant factor, and it can change over the course of time with regard to specific cases of interaction.

With respect to vertical interplay in particular, it is useful to draw a distinction between interactions between or among adjacent institutions and those that involve more remote arrangements. The most common forms of vertical interplay undoubtedly feature links between arrangements that deal with related issues and that are located at adjoining levels of social organization. Interactions between federal and state/provincial regimes dealing with the management of land and natural resources and between state/provincial and local arrangements

addressing matters of environmental quality or public health are prominent cases in point. But the onset of globalization has prompted a growing awareness of the significance of linkages between more remote levels of social organization. It is increasingly apparent, for instance, that developments centered on the (re)formation of global rules pertaining to the harvesting of marine mammals or tropical timber can have profound consequences for the sustainability of social practices operating at the level of smallscale, local communities. In the aggregate, moreover, outcomes flowing from the operation of many smallscale systems can generate cumulative consequences that are globally significant with regard to matters like the loss of biological diversity. As a result, interest in the nature and consequences of remote linkages is on the rise today, though adjacent linkages are likely to remain the primary focus of attention among those seeking to understand the dynamics of vertical interplay.

The category of vertical interplay encompasses a sizable family of interactive situations. No generally accepted taxonomy of types of vertical interplay exists at this stage, and this chapter does not attempt to devise one. Rather, the goal of the chapter is to illuminate the general character of vertical interplay by examining in some depth interactions across levels of social organization relating to land use and sea use. The emphasis here is primarily, though not exclusively, on vertical interplay arising from functional interdependencies in contrast to the deliberate or intentional links associated with the politics of design and management. The latter, which often become prominent in connection with efforts to solve problems arising from the impacts of functional interdependencies, constitute a separate theme and form the central topic addressed in the next chapter's analysis of horizontal interplay. Vertical interplay involving political design and management and horizontal interplay arising from functional interdependencies are of obvious importance in their own right. But in the interests of examining several specific types of interplay in depth and exploring the phenomenon of interplay in generic terms, I have chosen to set these cases aside in this chapter and the one that follows.

To be more explicit, this chapter analyzes the environmental consequences of vertical interplay in two relatively familiar settings. The first substantive section examines interactions between (sub)national arrangements pertaining to large marine and terrestrial ecosystems and smallscale or local arrangements featuring (often) informal practices involving systems of land tenure and sea tenure. This is followed by a section that directs attention to interactions between international regimes dealing with large marine and terrestrial ecosystems and parallel arrangements operating at the level of individual member states.¹ The principal conclusion arising from this account is that achieving sustainability in human/environment relations requires a commitment to creating arrangements that can manage functional interdependencies on an ongoing basis rather than an exercise aimed at selecting the proper level of social organization at which to respond to particular problems. More specifically, there are good reasons to be wary of the pitfalls associated with the formation of regimes at higher and more encompassing levels of social organization justified as a necessary condition for regulating human activities involving large marine and terrestrial ecosystems.

1. Interplay between (Sub)National and Local Resource Regimes

Patterns of land use and the sustainability of human/environment relations associated with them are determined, in considerable measure, by the interplay of (sub)national – predominantly modern and formal - structures of public property and local - largely traditional - systems of land tenure. For their part, patterns of sea use and the condition of the relevant marine ecosystems are affected greatly by the interplay of (sub)national regulatory systems legitimized by the creation of exclusive economic zones (EEZs) during the 1970s and 1980s and subsistence or artisanal practices guiding the actions of local users of marine resources. As a basis for analysis, this section explores the following hypotheses about these interactions. National

¹ . Interactions between national arrangements and state/provincial arrangements and between state/provincial arrangements and local arrangements are common in most domestic settings. So also are interactions between global arrangements and regional arrangements in international settings. The goal of this chapter, however, is to explore the nature of vertical interplay through an analysis of several prominent examples rather than to present a taxonomy of the various forms of vertical interplay.

arrangements afford greater opportunities to take into account the dynamics of large marine and terrestrial ecosystems (Sherman 1992). But regimes organized at the national level also facilitate and sometimes promote commodification or, in other words, largescale, consumptive, market-driven, and often unsustainable uses of targeted resources (e.g. forests, fish). They provide arenas in which the interests of powerful, non-resident players generally dominate the interests of smallscale, local users. Local systems, by contrast, favor smallscale uses of living resources that evolve over time from the experiences of resident harvesters; are less tied to market systems, and accord higher priority to sustaining local ecosystems over the long term. Because traditional, local and modern, national systems commonly coexist - though they seldom enjoy equal standing in relevant political and legal arenas – actual patterns of land use and sea use are affected substantially by the cross-scale interactions between these disparate systems operating at different levels of social organization. The account of these interactions developed here draws on examples relating to Southeast Asian forests, grazing lands in the Russian North, and fish stocks in the eastern Bering Sea to ground the analysis empirically. But similar forms of interplay involving a wide range of marine and terrestrial resources occur in many other settings.

1.1 Systems of Land Tenure

The authority of national governments to exercise jurisdiction over all the lands and natural resources located within the boundaries of the states in which they operate is widely acknowledged.² This is what accords governments the right to promulgate regulations applying to the activities both of owners of private property and of users of common property. But beyond this, governments can and often do assert far-reaching claims to the ownership of land and associated natural resources in the form of public property by virtue of conquest (e.g. Russian ownership of Siberia), the exercise of royal prerogative (e.g. the establishment of crown lands in Sweden), purchase (e.g. the acquisition of Alaska by the United States), inheritance (e.g.

² . Both Principle 21 of the 1972 Stockholm Declaration and Principle 2 of the 1992 Rio Declaration, for instance, declare that “States have ... the sovereign right to exploit their own resources ...”

Canada's inheritance of crown lands under the British North America Act of 1867), succession (e.g. Indonesia's claims to lands once owned by the Netherlands in the East Indies as an element in the process of decolonization and the acquisition of independence), or some combination of these discrete claims. In most countries, claims to public property are remarkably extensive. The concept of private property is nonexistent in Greenland. Despite the publicity surrounding privatization, the government of the Russian Federation still claims most of the land base of Russia as public property. The government of Canada treats the lion's share of the country's land base as public property.³ Even in the United States, which is widely regarded as a bastion of private property and free enterprise, the federal government alone claims about one-third of the nation's land as public property (Brubaker ed. 1984).

Yet this is not the whole story with regard to systems of land tenure. Although effective control has flowed steadily toward national governments during most of the modern era, many small (often indigenous) groups residing within states and engaging in distinctive social practices have not relinquished their claims to ownership of large tracts of land and natural resources in the form of common property (Berkes 1989, Bromley 1992). Often, these claims overlap or conflict with assertions on the part of (sub)national governments to the effect that the areas in question are part of the public domain. Indigenous land claims in British Columbia, for instance, cover virtually all the land area of the province. In some cases, national governments have recognized these claims and taken steps to reach settlements with indigenous claimants. Particularly noteworthy in this connection are the comprehensive settlements the government of Canada has negotiated with northern indigenous peoples over the last several decades and the cooperative arrangements under which the government of Denmark and the Greenland Home Rule handle matters pertaining to the use of land and natural resources in

³ Recent settlements of comprehensive claims with aboriginal peoples in the Canadian North have reduced the scope of public property somewhat and, at the same time, introduced some interesting arrangements featuring more complex systems of land tenure. Even so, public land remains the norm in Canada.

Greenland. In other cases, the efforts of local communities to assert ownership - or even use - rights have met with strong resistance on the part of national governments. Opposition to the efforts of Sweden's Sami to gain recognition of their rights relating to grazing lands constitutes a striking case in point (Svensson 1997). In still other cases, national governments have made little effort so far to take the claims of local communities to rights involving common property seriously. Throughout much of the Russian Federation, where the legacy of collectivization introduced during the period of Soviet rule remains strong, serious land claims on the part of local peoples are just beginning to surface (Fondahl 1998).

How can these clashes between the claims of national governments to public property and local claims to common property be resolved? In some cases, such as the settlement of Native land claims in Alaska, the eventual outcome has taken the form of a formal transfer of title to some lands to Native peoples (or organizations acting on their behalf), usually in return for acceptance on the part of these peoples of the extinguishment of residual claims to other areas.⁴ As experiences in places like Canada, Greenland, and Fenno-Scandia make clear, however, the concept of property encompasses a bundle of rights, and the contents of the bundle can be allocated in any of a variety of ways.⁵ This has given rise to lively debates about the nature and extent of usufructuary rights in situations where user groups have not been granted full title to land and natural resources. Among the most significant aspects of this debate are issues concerning the rights of national governments to authorize consumptive uses of forests, hydrocarbons, and nonfuel minerals in areas that are important to the conduct of traditional subsistence activities featuring the harvesting of living resources on the part of local peoples.

⁴ In the Alaska Native Claims Settlement Act of 1971 (PL 92-203), for instance, the federal government awarded full title to almost 44 million acres of land to Native corporation but, at the same time, declared that "All aboriginal titles, if any, and claims of aboriginal title in Alaska ... including any aboriginal hunting or fishing rights that may exist, are hereby extinguished" (Sec. 4b).

⁵ For an early, but still helpful treatment of property systems as social institutions see Hallowell (1943).

What difference does the resultant interplay between national systems of public property and local systems of common property make with regard to overall patterns of land use and to the sustainability of human/environment relations in various areas? The answer to this question emerges from a consideration of differences in the incentives of national policymakers and local decisionmakers. For the most part, governments can be expected to look upon public property as a means to promote the national interest through activities inspired by the search for export-led economic growth and the effort to attract foreign direct investment. More often than not, this means treating forests and nonrenewable resources as commodities to be harvested or extracted to meet the demands of world markets for raw materials. Two other factors reinforce this approach to the use of public property, especially in the developing world and in countries in transition. National governments tend to cater to the interests of politically powerful individuals who have no roots in local areas and who look upon concessions covering natural resources located on public property primarily as a means to amassing personal wealth. A particularly virulent form of this phenomenon involves the practice of crony capitalism and the emergence of black markets that many observers of Southeast Asia have described in detail (Dauvergne 1997a). International bodies (e.g. the multilateral development banks) whose mandates emphasize the acceleration of economic growth in developing countries have often acted to reinforce the resultant bias against the preferences of local peoples with regard to patterns of land use (Lipschutz and Conca 1993). The actions of the World Bank in supporting largescale irrigation systems, road construction, and nonrenewable resource extraction throughout the developing world offer striking illustrations of this phenomenon.

It would be a mistake to assume that the practices of local peoples do not cause major changes in ecosystems. There is ample evidence to demonstrate that swidden agriculture, the deliberate burning of forest understory, and the harvest of wildlife can all produce major environmental changes (Krech 1999). Yet so long as their traditional socioeconomic practices remain intact, local peoples do not have strong incentives to harvest timber for export, to extract

hydrocarbons or nonfuel minerals to sell on world markets, or to build massive dams to support largescale irrigation systems and industrial agriculture.⁶ Where systems of common property controlled by local users prevail, therefore, we can anticipate that patterns of land use will differ markedly from the patterns likely to arise where systems of public property prevail. In essence, we should expect to find a pronounced tendency toward largescale exports of products like timber, palm oil, hydrocarbons, and nonfuel minerals in systems where public property arrangements govern the use of land and natural resources. Local users operating under common property systems, by contrast, are more likely to use land to support subsistence lifestyles and to avoid the extractive and developmental patterns characteristic of public property systems. Naturally, the situation will be more complex in those increasingly common situations in which the balance between claims to public property and claims to common property is contested or in which efforts to resolve such contests have resulted in complicated and sometimes confusing allocations of the full bundle of property rights among several distinct groups of claimants.

To see how these interactions play out in practice, consider recent developments affecting the forests of Southeast Asia and the grazing lands of northern Russia. As a number of observers have pointed out, the tropical forests of Indonesia, Malaysia, and the Philippines have been harvested in an unsustainable fashion over the last several decades (Peluso 1992, Dauvergne 1997a). Peter Dauvergne, for example, has shown that "... loggers have degraded much of Southeast Asia's old-growth forests, triggering widespread deforestation" and that these activities "... irreparably decrease the economic, biological, and environmental value of old-growth forests" (Dauvergne 1997a: 2). Why has this happened? Many commentators have emphasized demand-side considerations, pointing to the role of Japan as a consumer of tropical timber and arguing that Japanese companies have few incentives to promote sustainable uses of Southeast Asian forests. At least as important, however, are supply-side considerations and, more specifically,

⁶ In cases where traditional socioeconomic practices have given way to mixed economies, local peoples may experience a growing need to exploit resources to generate a flow of cash.

the rules of the game governing decisions about alternative uses of Southeast Asian forests. A critical link in this story lies in the creation of systems of public property controlled by national governments as part of the process of decolonization and the establishment of independent states in Indonesia, Malaysia, and the Philippines in the aftermath of World War II. In effect, the emergence of public property in these countries made possible the pattern of forest degradation that has spread throughout this region. There is nothing in such arrangements that compels national governments to negotiate forest concessions in the quest for export-led growth and to engage in the practices referred to as crony capitalism. But the shifting balance between national systems of public property and local systems of common property has played a key role in allowing these developments to occur, since local users pursuing traditional lifestyles have no incentives to adopt strategies leading to forest degradation and, in the process, undermining the resource base needed to sustain these lifestyles. Among other things, this explains the views of many activists who see links between campaigns to reform land use practices that cause forest degradation and the struggle to strengthen the rights of indigenous peoples residing in rural areas of countries like Indonesia and Malaysia.⁷

A somewhat different illustration involves patterns of land use in northwestern Siberia where world-class reserves of oil and especially natural gas have been discovered in areas that indigenous peoples, such as the Nenets living on the Yamal Peninsula and the coastal plain of the Pechora River Basin, have traditionally used as communal migration routes and pastures for reindeer (Osherenko 1995). During the Soviet era, there was little doubt about the choice between hydrocarbon development and the protection of traditional lifestyles in this region. The national government claimed ownership of the area's land and natural resources as public or state property; oil and gas development was granted priority not only as a means to promote economic development but also as a source of hard currency earnings, and the concerns of the

⁷. For evidence of similar interactions occurring in other parts of the world see Gibson, McKean, and Ostrom (2000).

region's indigenous people's were generally ignored or treated as secondary concerns. At the time of its demise, the Soviet Union was the world's largest producer and exporter of natural gas. Yet as Gail Osherenko has shown, recent years have witnessed new developments in patterns of land use in this region (Osherenko 1995). This is partly a consequence of the collapse of the Soviet Union and the resultant economic decline occurring throughout the Russian Federation. In part, however, it reflects a growing effort on the part of indigenous peoples to reclaim reindeer from the collective and state farms of the Soviet era and to reassert common property rights to the migration routes and grazing lands needed to sustain local economies. From the perspective of these peoples, this pattern of land use is superior to nonrenewable resource development, regardless of world market prices for oil and natural gas (Golovnev and Osherenko 1999). It is far too soon to make predictions about what the future will bring in this region. The development of gas fields on the Yamal Peninsula, for example, is currently in a state of suspended animation. A revival of the overall Russian economy could well generate pressure to resume the construction of gas fields and transportation corridors in this sensitive area. But it is clear that the shifting balance between public property and common property will play a role of considerable importance in determining future patterns of land use in northwestern Siberia.

1.2 Systems of Sea Tenure

The story of sea tenure differs - often quite dramatically - from the account of land tenure set forth in the preceding subsection. Whereas we have no difficulty organizing our thinking around concepts like patterns of land use and systems of land tenure, comparable phrases relating to marine resources - "sea use" and "sea tenure" - have an odd ring to them. Why is this the case? Broadly speaking, it is fair to say that this divergence stems from the fact that there is little experience with private property and only a limited history of public property in the ordinary or normal sense of the term when it comes to the management of human uses of marine resources.

Part of the gap between arrangements dealing with land use and their counterparts governing sea use is attributable to the fact that it is often difficult and sometimes nearly impossible to establish effective exclusion mechanisms applicable to marine resources. This is so because marine resources run together in a fluid manner and, in the case of living resources like fish, often feature organisms that move freely from place to place in ways that would frustrate any efforts to establish possessory rights that run with individual owners. Seeking to create private property rights in many fish stocks would be like endeavoring to turn flocks of migratory birds into private property in systems of land tenure. Even so, it would be a mistake to exaggerate this argument regarding property rights in marine resources. In cases where the relevant resources are sedentary (e.g. clam and oyster beds), there is a good deal of experience with the creation of property rights, especially in the form of use rights that allow their holders to exclude others from harvesting living resources like clams or oysters in designated locations. Even more highly developed are the rights accorded to those who engage in various forms of aquaculture which depend upon the existence of secure rights to fish pens and other well-defined marine structures. As these last observations suggest, moreover, it is important to consider arrangements under which individual elements in the bundle of rights associated with property come into play, even when there is little prospect for establishing systems based on the full bundles of rights we ordinarily have in mind in thinking about private property and public property. There are many situations, for example, in which use rights to particular fish stocks have been established in such forms as preferences granted to harvesters using particular locations and specific types of gear or rights to harvest a specified proportion of the total allowable catch (TAC) established for a specific fishery in any given year. The recent growth of systems of individual transferable quotas (ITQs) in a variety of fisheries is particularly noteworthy in this connection (Iudicello et al. 1999).

In part, the scarcity of systems of private property and public property associated with marine resources arises from restrictions on the authority or the capacity of states to exercise

jurisdiction over marine systems. From the beginnings of the modern states system in the seventeenth century, states have been treated as territorial units possessing virtually unlimited jurisdiction over terrestrial ecosystems located within their borders but very limited jurisdiction over adjacent marine systems (Anand 1983). Early on, states began to assert some jurisdiction over waters located adjacent to their coasts in the form of a narrow belt known as the territorial sea. For the most part, however, the granting of jurisdiction over the territorial sea was justified as an arrangement required for purposes of security. Under this arrangement, coastal states agreed to allow outsiders to engage in a variety of activities – innocent passage of ships, the laying of submarine cables, overflight by aircraft – taking place within or affecting their territorial seas. Beyond this belt, states considered it impermissible or inappropriate to lay claim to marine systems as public property in the sense of areas actually owned by the state in the same way that the state owns the public domain.

Given this background, it makes sense to look upon the twentieth century as an era marked by the expansion of the jurisdiction of coastal states over marine systems in both spatial and functional terms (Juda 1996). The three-mile territorial sea has grown to twelve miles, and the establishment of exclusive economic zones (EEZs) has granted coastal states jurisdiction over approximately a third of the world ocean and most marine living resources. Justified largely on the basis of arguments framed in terms of conservation or the achievement of sustainable use, the expanded jurisdiction of coastal states over marine systems now extends to the management of a range of activities dealing with the harvesting of both renewable and nonrenewable resources and with the protection of marine systems from various forms of pollution. Even so, it is important to note that the jurisdiction of coastal states over adjacent marine systems still falls short of the bundle of rights that states exercise over terrestrial systems located within their borders. Coastal states do not have the authority to transfer title to marine systems per se to private owners in the way that states have traditionally been able to dispose of sizable portions of the public domain. In many states, it is considered inappropriate even for governments to collect economic

returns from the use of marine resources treated as factors of production, a practice that is considered routine in situations involving the use of natural resources (e.g. timber, hydrocarbons) located on the public domain. These restrictions have not deterred states from developing regulatory regimes operated by government agencies (or their subunits) and intended to ensure that users of marine resources pay attention to matters of sustainability and environmental quality associated with their activities. Nor have they precluded the introduction of arrangements like ITQs in which states create rights to harvest specific fish stocks. Nonetheless, they have produced a situation in which it seems awkward to think in terms of systems of sea tenure.

At the same time, there are substantial parallels between systems of land use and systems of sea use when it comes to the operation of smallscale, traditional arrangements, quite apart from the aggregation of management authority in the hands of the state. In virtually every case, these local arrangements can be thought of as featuring some form of common property (Pinkerton 1989). Not surprisingly, numerous variations occur, depending upon the character of the biogeophysical systems involved, the nature of the harvesting procedures employed, and the content of the cultural norms operative among the members of the group of appropriators. Nonetheless, almost all these systems have a number of features in common. Although they do not assign full bundles of rights to individual users, they often do grant individuals priority in the use of particular fishing sites or the use of specific gear types. They typically exclude outsiders or, in other words, nonmembers of the relevant group or community from using the resources in question. They normally feature informal arrangements that evolve on the basis of trial and error and that undergo de facto adjustments over time as a way of adapting to changing conditions in the relevant biogeophysical systems or changing circumstances of the societies within which they operate. Yet the rules in use that comprise these institutional arrangements are well understood by members of the user communities, and they are buttressed in most cases by compliance

mechanisms that are effective in bringing the behavior of individual appropriators into conformance with the constellations of rights and rules that make up the core of these practices.⁸

How have these traditional arrangements governing the use of marine resources performed in practice? As in the case of systems of land tenure, it would be a mistake to idealize indigenous or artisanal systems of sea use. To be sure, anthropologists have succeeded in documenting a sizable number of cases in which these local systems have proven sustainable over relatively long periods of time. A particularly intriguing feature of these studies is the evaluation of compliance mechanisms (e.g. arrangements featuring taboos) that prove effective from the point of view of guiding the behavior of users toward sustainable practices, even when they are not based on any scientific understanding of the dynamics of the ecosystems in question (Fienup-Riordan 1990). Nonetheless, there is no basis for assuming that all traditional systems of sea tenure produce results that are sustainable. Although this is a sensitive and – in some circles - contested matter, there is little doubt that the actual record associated with traditional systems of sea use features a fair number of failures as well as successes, especially in cases involving volatile biogeophysical systems that undergo non-linear changes from time to time.

By the same token, the record compiled by the regulatory regimes created by (sub)national governments to guide uses of marine resources is generally unimpressive. Justified in large part by the need to manage large marine ecosystems on an integrated basis and to bring to bear the insights of science in order to ensure sustainability in the use of marine resources, these regimes have proven insufficient to prevent a growing crisis in many of the world's fisheries brought on by an excess of harvesting capacity and an inability - both scientifically and politically – to establish and enforce appropriate quotas or other restrictions governing the consumptive use of living marine resources (McGoodwin 1991). In fact, national governments

⁸ . For an extended account of the role of rules in use and the relationship between such rules and formal rules see Ostrom (1990).

have regularly provided subsidies to harvesters in a manner that has led to the acquisition of larger and more powerful harvesting capabilities along with heavy debt loads. As this last observation suggests, moreover, the regulatory regimes established by national governments have exhibited a marked tendency to favor the interests of some types of users over others. Thus, large, well-financed, and politically active harvesters have generally profited from the introduction of national systems of sea use in contrast to smallscale subsistence or artisanal harvesters who have little experience beyond the local level and few of the resources needed to influence national (or even subnational) policies relating to the use of marine resources.

Overall, it seems fair to say that the result has been a commodification of marine resources favoring large commercial operators over small operators. This has caused an erosion of the role of traditional common property approaches to sea tenure leading to outcomes that are hard to defend in terms of conservation or even efficiency. Recently, national regulators have begun to experiment with a range of policy instruments (e.g. permits to fish, individual transferable quotas or ITQs) intended to eliminate or suppress some of the worst features of this commodification (Iudicello, Weber, and Wieland 1999). The track record associated with these efforts is not yet extensive enough to justify firm conclusions. Taken together, it is probably accurate to conclude that these institutional innovations show considerable promise at least as responses to the specific problem of overharvesting (NRC 1999, Hanna et al. 2000). Yet there is no basis at this stage for granting high marks to state-based systems of sea tenure with regard to the production of outcomes that are sustainable over time, much less results that can be defended on grounds of efficiency or equity.

To see how the interplay between modern, national and traditional, local systems of sea tenure plays out in practice, consider the situation that has developed in the eastern Bering Sea Region over the last twenty-five years (NRC 1996). During the 1970s, the State of Alaska instituted a limited-entry regime for the inshore fisheries of this area - those fisheries taking place

within a three-mile belt over which the state has jurisdiction – largely in response to declining harvests of salmon (Young 1983). Shortly thereafter, the federal government followed suit by creating a Fishery Conservation Zone (FCZ) together with a set of regulatory arrangements dealing with the harvesting of all species of fish in an area extending from the outer boundaries of state jurisdiction to a point two hundred nautical miles from the coastline (Young 1982). Although it would be unfair to argue that these initiatives have had no positive consequences, they have given rise to a number of unintended side effects due largely to problems of interplay with other institutional arrangements. The limited-entry system covering inshore fisheries has disrupted traditional arrangements featuring a fluid mix of subsistence and commercial harvesting; placed severe restrictions on the ability of young people unable to afford the price of a permit to enter the fisheries, and led to a loss of permits among rural fishers whose financial insecurity leads them to succumb from time to time to the temptation to sell fishing permits to meet short-term needs for cash. For its part, the creation of the FCZ in the eastern Bering Sea precipitated a dramatic rise in the participation of American fishers in this area and the consequent phasing out of foreign fishers. Because the regime established to regulate fishing in this area has the status of a national arrangement, the State of Alaska has been barred from instituting measures to protect local fishers in the area from competition on the part of large, heavily-capitalized fishers based in Washington and Oregon. The exclusion of foreign fishers from the FCZ led them to shift their focus to an area of the central Bering Sea located just outside the FCZ and known as the doughnut hole.⁹ By the early 1990s, the pollock stocks in this area had collapsed.

During the 1990s, both the U.S. federal government and the State of Alaska took some steps to address these unfortunate side effects arising from the institutional innovations of the 1970s and 1980s. These include the creation of community development quotas (CDQs) intended to bolster the economies of small, coastal communities (NRC 1999b) and the negotiation

⁹ . The doughnut hole constitutes a pocket of high seas wholly surrounded by the EEZs of Russia and the United States.

of a six-nation convention designed to address the problem of overharvesting of pollock in the central Bering Sea (Balton forthcoming). Although these are clearly steps in the right direction, it is premature at this stage to conclude that they will solve the problems arising from institutional interplay in the Bering Sea Region. CDQs do not provide a substitute in sociocultural terms for the existence of a strong cadre of individual fishers, and the pollock stocks of the doughnut hole have yet to recover sufficiently to activate the management procedures established under the 1994 convention. Accordingly, there is a real danger that the innovations of the 1990s will be assessed in the future as responses that were too little and too late. In any event, it is clear that the growth of coastal state jurisdiction over marine resources and the subsequent emergence of (sub)national systems governing sea use have triggered new forms of institutional interplay in this realm whose consequences have proven costly not only for many individuals but also for the welfare of small, coastal communities in an area like Alaska.

2. Interplay between International and National Resource Regimes

Turn now to institutional interplay occurring at higher levels of social organization and, more specifically, to the hypothesis that the effectiveness of international resource regimes – measured in terms of efficiency and equity as well as sustainability – is determined, in considerable measure, by interactions between rules and decisionmaking procedures articulated at the international level and the political, economic, and social systems prevailing within individual member states. International regimes normally set forth generic rules applicable to all their members, leaving the implementation of these rules to be carried out for the most part by public agencies and actors located within individual member states.¹⁰ But member states often have preexisting domestic arrangements pertaining to the specific issues at hand. In any case, they have broader political and legal systems adapted to their own circumstances. As a result, the outcomes arising from the operation of international resource regimes will be sensitive to

¹⁰ . Some recent arrangements (e.g. the ozone and climate regimes) differentiate among classes of members with regard to the specification of obligations and the application of rules.

interactions with national arrangements; performance is apt to vary substantially from one member state to another. Following an account of the logic of this hypothesis, this section explores cases relating to regimes applicable to tropical timber in Southeast Asia and protected natural areas in the Circumpolar North and to regimes dealing with the fisheries of the Barents and Bering Seas. As in the case of interplay between national and local institutions, similar dynamics occur in many other settings.

2.1 Competence, Compatibility, and Capacity

It is tempting to assume that states that sign and ratify conventions or treaties establishing international regimes will proceed to carry out the obligations assumed under these agreements as a matter of course. As numerous studies of national implementation of international obligations have shown, however, there is no basis for making such an assumption. In fact, implementation typically varies greatly from one regime to another as well as among individual members of the same regime. As a result, the examination of factors influencing implementation at the national level has become an important area of emphasis for regime analysis (Underdal 1998, Weiss and Jacobson 1998, Victor, Raustiala, and Skolnikoff 1998, Underdal and Hanf 2000)). What are the key factors that determine whether members succeed in implementing the rules of international agreements within their own jurisdictions and whether they accept the results of decisionmaking procedures operating under the auspices of international regimes? In some cases, this is essentially a matter of political will. Governments can and do sign agreements they have no intention of implementing; executive branch officials who sign international agreements in good faith may be unable to persuade legislators to pass implementing legislation and to allocate resources needed to operate these arrangements, and changes in the composition of governments can bring to power officials who did not participate in the creation of a regime and have little interest in fulfilling obligations undertaken by their predecessors. At the same time, three sets of factors that are more general in nature and that bear

directly on the matter of institutional interplay have emerged as important considerations in this context. For shorthand purposes, I call them competence, compatibility, and capacity.

Competence is a matter of the political and legal authority needed to implement commitments made at the international level. Competence in this sense is largely a function of the constitutional arrangements prevailing within individual states. In the United States, for instance, international conventions do not become legally binding until they are ratified by a two-thirds majority in the Senate. Even then, the American constitution does not guarantee that commitments embedded in legally binding conventions will always take precedence over domestic laws.¹¹ As a result, American negotiators in international forums frequently oppose otherwise attractive institutional arrangements on the grounds that there is little prospect that they can survive the pressures arising from domestic legal and political processes. Small wonder, then, that those representing other states frequently view the United States as a difficult partner when it comes to the creation and implementation of international regimes. In other cases, the problem arises from the allocation of authority between national and subnational units of government in contrast to the separation of powers among the components of national governments. In the Canadian confederation where authority over many issues resides with the provinces in contrast to the federal government, for example, the government in Ottawa lacks the competence to enter into legally binding commitments at the international level regarding many issues, without seeking the explicit consent of the individual provinces.

Compatibility is a matter of the fit between institutional arrangements set up under the provisions of international agreements and the social practices prevailing within individual member states. Whereas competence is a matter of authority, compatibility concerns standard practices or procedures for handling governance issues that grow up in political systems over

¹¹. In the terminology of international law, the United States has a dualist system in contrast to a monist system (Higgins 1994: Ch. 12).

time. Given the character of international society, there is general agreement on the proposition that member states should be free to implement international commitments within their own jurisdictions in whatever way they choose to do so. But this does not eliminate the problem of institutional fit. Consider, by way of illustration, a case in which an international regime calls for the establishment of a system of tradable permits (e.g. permits for exclusive use of bands in the electromagnetic spectrum, permits for extracting minerals from specific sites on the deep seabed, permits for emitting specific quantities of greenhouse gases), while the social practices prevailing within some of the member states are based on the use of command-and-control regulations offering little or no scope for the sorts of incentive mechanisms associated with the creation of tradable permits. To make this concern more concrete, think of the issues now coming into focus with regard to the allocation of slots in the geostationary orbit or bands in the electromagnetic spectrum. For those committed to the proposition that tradable permits are essential to ensure efficiency and, therefore, to secure widespread acceptance of arrangements governing the use of these resources, the virtues of allowing and even promoting the emergence of markets in slots and bands seem beyond doubt. Yet such mechanisms are alien to the political cultures of many countries, and government agencies in these countries are lacking in experience with mechanisms of this sort which would allow them to assimilate such a governance system into familiar and well-understood ways of doing business (Chertow and Esty 1997).

For its part, capacity is a measure of the availability of the social and institutional capital as well as the material resources needed to make good on commitments entered into at the international level (Chayes and Chayes 1995, Keohane and Levy 1996). We are used to paying attention to the problem of capacity in cases where the economic and political systems of developing countries lack the resources needed to shift to alternative technologies (e.g. substitutes for ozone-depleting substances) or to enforce international rules within their jurisdictions (e.g. rules pertaining to trade in endangered species) (Gibson 1999). But issues of capacity also arise in connection with the actions of advanced industrial countries. In the United States, for instance,

international commitments are frequently treated with benign neglect in cases where no individual agency is willing to take responsibility for their implementation (that is, to become what is known as the lead agency) or responsible agencies are unable or unwilling to obtain the material resources required to play this role. Consider, in this connection, the contrast between American participation in the regime for Antarctica where there is no doubt about the role that the National Science Foundation plays as lead agency for matters relating to this arrangement and in the emerging regime for the Arctic where a dozen or more agencies demand a say in what happens but none is able or willing to accept the role of lead agency (Osherenko and Young 1989: Ch. 8).

As this discussion makes clear, international regimes normally operate in social settings featuring substantial institutional heterogeneity among their members. What is more, those responsible for administering international regimes are seldom in a position to resort to what constitutes the normal procedure for handling interplay of this sort between national and subnational governments, a setting in which national governments generally possess the ultimate authority to compel subnational governments to adjust their rules and procedures to ensure that they do not conflict with arrangements established at the national level. The result is a mode of operation in which the rules of international regimes are framed in terms that are sufficiently generic to allow officials within individual member states considerable leeway in operationalizing them within their own jurisdictions. Up to a point, this is clearly desirable. National officials are not about to let the managers of international regimes dictate to them, and there is much to be said for allowing individual members to assimilate the rules of international regimes into their own systems in ways they deem appropriate. But this situation accentuates the line of thinking under consideration here to the effect that the consequences of international regimes will be determined in considerable part by the interplay between the regimes themselves and national practices prevailing in individual member states. Among other things, this should lead us to expect considerable variance in the performance of member states when it comes to fulfilling commitments made during processes of regime formation. This variance may not be critical to the

overall performance of international regimes. In the case of equipment standards applicable to the construction of oil tankers, for instance, the regime can be expected to operate effectively so long as a few key member states take the standards seriously (Mitchell 1994). But in other cases, such as phasing out the production and consumption of ozone-depleting chemicals (French 1997), it is apparent that it takes conformance on the part of all but the most marginal members to achieve effective protection of the relevant natural systems.

2.2 Regimes for Terrestrial Resources

To think concretely about the impact of this form of interplay on patterns of land use, consider some examples relating to the operation of the International Tropical Timber Agreement (ITTA) and the effort to create a Circumpolar Protected Areas Network (CPAN) in the Far North. The ITTA, created initially in 1983 and substantially restructured in 1994, is first and foremost a trade agreement in which producers (e.g. Indonesia, Malaysia, and the Philippines) and consumers (e.g. Japan) of tropical timber endeavor to stabilize and regulate the world market in wood products harvested from tropical forests (Humphreys 1996, Dauvergne 1997b). What makes this regime interesting from an environmental point of view is the recognition that a high proportion of the harvesting of tropical timber in recent decades has taken the form of highly destructive practices best described as the "mining" of forests and that there is a need to restructure the industry to put it on a more sustainable basis. The centerpiece of the 1994 agreement is a commitment on the part of regime members to implement a system of guidelines intended to ensure that both natural and planted tropical forests are managed sustainably and that biological diversity is protected in these forests. To this end, regime members committed themselves to the Year 2000 Objective which calls for all tropical timber entering international trade to be produced from forests under sustainable management by the year 2000. What are the prospects that this objective will be met during the near future? The answer depends on the interplay between the international regime itself and the national political systems of member countries, such as Indonesia and Japan (Guppy 1996). At this stage, the prognosis is not

particularly encouraging. Given the economic and political turmoil affecting Southeast Asia in recent years combined with the continuing grip of crony capitalism, the capacity of a country like Indonesia to meet the Year 2000 Objective is limited, and the sanctions associated with non-conformance are likely to prove ineffectual. For its part, the severity of the economic downturn that has plagued Japan recently together with the political influence of the major companies involved in the tropical timber trade creates a setting that is not conducive to bringing effective pressure to bear on domestic users of tropical timber.

A major goal of the Arctic Environmental Protection Strategy (AEPS) - launched in 1991 but integrated since 1996 into the broader structure of the Arctic Council - is to promote the conservation of flora and fauna in the Circumpolar North (Huntington 1997). To this end, the AEPS established a Working Group on the Conservation of Arctic Flora and Fauna (CAFF) and provided it with a mandate to take the initiative in devising innovative means to achieve its general goal. Despite the relative weakness of CAFF in terms of formal authority, this initiative has generated a good deal of interest. CAFF has become a forum in which government officials and representatives of nonstate actors interact freely; it has succeeded in capturing and holding the attention of public agencies in a number of member states, and it has emerged as a mechanism for applying universal guidelines relating to biological diversity to the particular circumstances prevailing in the Circumpolar North.¹² One of CAFF's highest priorities has been to promote and oversee the creation of a Circumpolar Protected Areas Network (CPAN) or, in other words, a linked system of parks, preserves, wildlife refuges, and so forth located in all the Arctic countries and organized in such a way as to provide harmonized management for the entire system (CAFF 1996). The success of this initiative depends largely upon the willingness and the ability of management agencies located within individual member states to collaborate effectively or, in other words, to manage protected natural areas on a coordinated basis. This is where

¹². Updates on the work of CAFF appear regularly in the *Arctic Bulletin*, published four times a year under the auspices of the WWF Arctic Programme.

problems begin to arise in connection with this intuitively appealing initiative. Within some of the key countries - the United States is a good example - management authority regarding the areas involved resides with a number of distinct agencies (e.g. the National Parks Service, the Fish and Wildlife Service, the Geological Survey, the Bureau of Land Management) that are not in the habit of cooperating effectively with one another, much less with their counterparts in other countries (Clarke and McCool 1996). In other countries - the Russian Federation is a prime example - economic and political problems are so severe at this time that there is little energy and few resources available for international cooperation. This initiative does not require integrated management across national jurisdictional boundaries; coordinated or harmonized management practices carried out by relevant agencies within each country would suffice. Yet the complexities of institutional interplay between international commitments and national practices raise serious questions about the prospects for CPAN.

2.3 Regimes for Marine Resources

Turning now to institutional interplay relating to marine resources in the Barents Sea and the Bering Sea, an even more complex pattern of institutional interplay comes into focus. In effect, the regimes that have emerged in these areas feature interactions between and among three distinct sets of institutional arrangements: the global rules governing EEZs, the national and subnational regulatory systems that individual coastal states have put in place within their own EEZs, and several regional arrangements created to deal with situations in which national EEZs either adjoin each other (i.e. the relevant states are adjacent or opposite states) or leave pockets of high seas surrounded by national EEZs. Although the introduction of EEZs was justified in large measure as an institutional innovation required to manage human uses of marine living resources on a sustainable basis, it soon became apparent that this institutional innovation created a range of new problems, quite apart from its consequences with regard to the treatment of preexisting problems. Marine ecosystems do not conform to any legal or political boundaries, however ingenious the effort to delineate them may be. As a result, many states that acquired

expanded jurisdiction over the harvesting of living resources in their individual EEZs now find themselves confronted with a sizable collection of new problems relating to what have become known as straddling stocks. One response to this development, intended to coordinate efforts to manage marine resources located partly within an EEZ and partly in the high seas, is embodied in the Fish Stocks Agreement, a global arrangement negotiated in the wake of the UN Conference on Environment and Development and signed in 1995.¹³ Another response, intended primarily to coordinate the efforts of adjacent and opposite states to manage fish stocks common to their individual EEZs and related areas of the high seas, has taken the form of the creation of a growing collection of regional fisheries regimes.

Two particularly interesting examples of these regional arrangements are the predominantly bilateral Norwegian/Russian regime dealing with the fisheries of the Barents Sea and the multilateral arrangements that have emerged in the Bering Sea Region (Stokke forthcoming). Not only do these cases exemplify different ways of dealing with institutional interplay; they also have produced significantly different outcomes. In the Barents Sea, Norway and Russia capitalized on the emergence of EEZs during the 1970s to create a bilateral regime that has phased out or drastically curtailed participation on the part of fishers from third states and that has put in place a system under which the principal fish stocks of the entire region are managed on an integrated basis (Stokke, Anderson, and Mirovitskaya 1999). This system is not immune to biophysical surprises. It has had to adjust to changing biological conditions (e.g. the location of spring spawning herring), and it has had to cope with severe stresses attributable to the transition from the Soviet Union to the Russian Federation and the subsequent decline in the capacity of Russia to regulate the activities of Russian fishers (Hønneland 1999, Stokke forthcoming). But this is a case in which the interplay between two sets of national arrangements

¹³ . The Fish Stocks Agreement also encompasses other goals, such as devising rules designed to achieve sustainable harvesting of highly migratory species (e.g. tunas).

and an international regime has been managed in such a way as to avoid crises requiring the closure of important fisheries.

The situation that has emerged in the Bering Sea Region, by contrast, illustrates a somewhat less auspicious response to institutional interplay. Russia and the United States responded to the creation of EEZs by establishing complex but somewhat poorly coordinated national regimes in the western Bering Sea and the eastern Bering Sea respectively. In addition, the 1990s brought the creation of a regional agreement covering salmon stocks migrating back and forth through the EEZs of the two countries along with a six-nation agreement dealing with the pollock stocks of the doughnut hole and designed to prevent a recurrence of the collapse of these stocks that occurred in the late 1980s and early 1990s. But the results of this complex mosaic are far from reassuring. Both coastal states have experienced severe problems in controlling harvests of living marine resources within their own EEZs. The pollock stocks of the doughnut hole have not recovered sufficiently to allow for any harvesting under the terms of the international agreement created to manage these stocks. Above all, there are a number of disturbing indications that anthropogenic forces have triggered severe stresses affecting the Bering Sea ecosystem as a whole (NRC 1996, National Marine Fisheries Service 1997, WWF/TNC 1999). These include startling declines in populations of several unharvested species, such as sea lions, northern fur seals, sea otters, and red-legged kittiwakes, as well as some harvested species, such as spectacled eiders and several species of geese. No doubt, it would be wrong to point to problems of institutional interplay as the sole - or even primary - cause of these disturbing developments. But it is hard to avoid the conclusion that difficulties plaguing efforts to coordinate institutional arrangements across levels of social organization constitute a significant feature of this story.

3. Implications and Take-Home Messages

The principal conclusion to be drawn from the analysis presented in this chapter is that cross-scale interactions among resource regimes generate an inescapable tension between the

benefits and costs of higher level arrangements. The move to higher levels of social organization makes it possible to consider interdependencies in large marine and terrestrial ecosystems and to devise regimes based on the precepts of ecosystem management. Yet there are costs to operating at higher levels measured in terms of an inability to come to terms with local variations in biogeophysical conditions and a lack of sensitivity to both the knowledge and the rights and interests of local stakeholders.

Those operating at higher – national or international – levels are typically compelled to devise and promulgate structures of rights and regulatory rules in terms that are broad and generic. While this may cause few problems in dealing with large marine and terrestrial ecosystems that are homogenous, problems mount rapidly where there are local variations both in pertinent biogeophysical conditions (e.g. the population dynamics of fish stocks) and in patterns of human uses of natural resources (e.g. hunting and herding practices). The result more often than not is a proliferation of formal rights and rules that are poorly suited to local circumstances or the evolution of systems so encrusted with local exceptions and informal interpretations that they become unworkable. Similar observations are in order regarding the rights and interests of various groups of stakeholders. Moving to higher levels of social organization can open up opportunities for increased efficiency in the use of resources and for more comprehensive approaches to equity. But the costs associated with such developments are often substantial. National regimes increase the influence of economically and politically powerful actors who do not reside within the ecosystems they exploit; who simply move on to new areas once the resources of one area are exhausted, and who favor the exploitation of resources that are tradable in (often international) markets. For their part, international regimes often cater to the interests of multinational corporations which have operations located in many places and which have no long-term commitment to the ecological welfare of particular areas or the social welfare of those who reside permanently in these areas. Under the circumstances, it is easy to see that shifts to higher levels of social organization justified in order to manage large marine and terrestrial ecosystems in a

holistic manner can and often do lead to changes in patterns of land use and sea use that raise profound questions not only in terms of sustainability but also in terms of normative concerns including equity as well as efficiency.

The vigor of the debate about what is often called the subsidiarity principle is testimony to the importance of this tension regarding the environmental consequences of cross-scale interactions.¹⁴ But this principle, which calls for the creation of management systems that lodge authority at the lowest level of social organization capable of solving pertinent problems, does not offer much help in coming to terms with the problems of cross-scale interplay addressed in this chapter. National and even international arrangements are needed to manage human activities relating to large marine and terrestrial ecosystems. Yet the dangers inherent in moving from local to national and from national to international regimes are severe. What is needed, under the circumstances, is a conscious effort to design and operate institutional arrangements that recognize local knowledge and protect the rights and interests of local stakeholders even while they introduce mechanisms at higher levels of social organization required to encompass the dynamics of ecosystems that are regional and even global in scope.

This is not a task to be handled by means of unequivocal decisions regarding the proper level of social organization at which to vest management authority. A more interesting response to this tension involves arrangements that numerous analysts have explored in recent years under the rubric of comanagement (Osherenko 1988, Berkes 2000). In the typical case, comanagement involves the creation of an environmental or resource regime featuring working partnerships between local users of natural resources and (sub)national agencies possessing the formal authority to make decisions about human activities involving marine and terrestrial ecosystems as well as the resources needed to administer management systems. This intrinsically appealing

¹⁴ . The longstanding tension in American wildlife law regarding the allocation of authority between the governments of the states and the federal government illustrates this debate.

approach may well give rise to a range of social practices that are of lasting significance in dealing with specific problems of vertical interplay. But it would be premature to jump to any such conclusion at this stage. Comanagement is in danger of becoming a catch-all conceptual category containing a ragtag collection of tenuously related arrangements. Even in dealing with the interplay between local and national arrangements, experience on the ground with comanagement is limited, and we are far from the formulation of well-tested propositions about the determinants of success and failure in the creation and operation of comanagement regimes. It is anything but clear whether experience with comanagement in dealing with local/national interactions can be scaled up to offer an effective method of organizing the interplay between national and international regimes. These observations are not meant to belittle the significance of comanagement as a strategy involving political design and management as a means of coming to terms with problems arising from functional interdependencies; many analysts are engaged in interesting studies of comanagement at the present time. Nonetheless, there is much to be done before we can assert that substantial progress is being made in coming to terms with the tensions arising from cross-scale interactions.

We must bear in mind as well that the creation of institutions at every level of social organization is a political process centering on what is often called institutional bargaining (Young 1994a). Whatever their consequences in terms of considerations like sustainability or efficiency, environmental or resource regimes always have significant consequences for the interests of those - nonstate actors as well as states - subject to their rules and decisionmaking procedures. It should come as no surprise, therefore, that individual actors often work hard to advance their own causes in processes of regime formation and that outcomes typically reflect the political influence of major participants or coalitions of participants in these processes. This is not to suggest that efforts to design institutions that will promote social goals like sustainability or efficiency will always be exercises in futility. In fact, institutional bargaining has some features that make it more open to design considerations than conventional or distributive bargaining. Yet

there is no escaping the fact that regime formation is better understood as a political process in which bargaining strength plays a central role than as an exercise in social engineering in which apolitical design principles predominate.

4. In Conclusion

The argument of this chapter is intended to initiate a dialogue regarding the role that vertical interplay involving cross-scale interactions among distinct institutions plays in the overarching picture of the human dimensions of environmental change. The cases of land use and sea use are particularly interesting in this connection because patterns of land and sea use are directly and intimately linked to largescale environmental changes, such as the loss of biological diversity and climate change. But similar issues of institutional interplay arise in conjunction with other concerns, including human uses of atmospheric and hydrological systems. There is no assumption here that institutions in general or the interplay among distinct institutions in particular can account for all the variance in the impacts of human actions on atmospheric, hydrological, marine, or terrestrial systems. On the contrary, institutional drivers interact with other forces in complex ways; one of the main challenges facing those interested in the human dimensions of largescale environmental change is to sort out the relative significance or weight of institutional drivers and other driving forces.

Yet an emphasis on the role of institutions in this connection has great appeal, so long as care is taken to avoid the assumption that institutional arrangements operate in a vacuum in the sense that they produce results without regard to the character of the broader biogeophysical and socioeconomic settings in which they operate. The content of prevailing institutions is subject to intentional reform, a fact that opens up the opportunity to respond to functional interdependencies by turning to political design and management in the interests of minimizing the negative consequences of existing institutions and supplementing or even replacing these arrangements in order to mitigate or adapt to largescale environmental changes. The message of

this chapter regarding this prospect is one of great caution but certainly not one of pessimism. Even if we succeed in identifying the institutional forces giving rise to environment problems, there is no guarantee that we can take the steps needed to alter the operation of prevailing arrangements in a well-planned fashion. Nonetheless, the prospect that (re)designing institutions can play a role in controlling or managing largescale environmental changes provides a compelling reason to invest time and energy in enhancing our understanding of the dynamics of institutional interplay.